

JP2001076852A

2001-3-23

Bibliographic Fields

Document Identity

(19)【発行国】

日本国特許庁(JP)

(12)【公報種別】

公開特許公報(A)

(11)【公開番号】

特開2001-76852(P2001-76852A)

(43)【公開日】

平成13年3月23日(2001. 3. 23)

Public Availability

(43)【公開日】

平成13年3月23日(2001. 3. 23)

Technical

(54)【発明の名称】

面状発熱体

(51)【国際特許分類第7版】

H05B 3/20 305

315

373

384

389

3/14

3/18

【F1】

H05B 3/20 305

315

373

384

389

3/14 A

3/18

【請求項の数】

10

(19) [Publication Office]

Japan Patent Office (JP)

(12) [Kind of Document]

Unexamined Patent Publication (A)

(11) [Publication Number of Unexamined Application]

Japan Unexamined Patent Publication 2001 - 76852 (P2001 - 76852A)

(43) [Publication Date of Unexamined Application]

Heisei 13 year March 23 days (2001.3.23)

(43) [Publication Date of Unexamined Application]

Heisei 13 year March 23 days (2001.3.23)

(54) [Title of Invention]

PLANAR HEATER

(51) [International Patent Classification, 7th Edition]

H05B 3/20 305

315

373

384

389

3/14

3/18

【F1】

H05B 3/20 305

315

373

384

389

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【Number of Claims】

10

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JP2001076852A

2001-3-23

【出願形態】

書面

【全頁数】

4

【テーマコード(参考)】

3K0343K092

【Fターム(参考)】

3K034 AA02 AA05 AA07 AA08 AA10 AA24
AA34 BB05 BB08 BB13 BB15 BB16 BC02
BC03 BC09 BC16 BC17 BC23 3K092 QA05
QB21 QB31 QB76 RF02 RF03 RF04 RF11
RF14 RF26 RF27 TT27 VV03 VV40

Filing

【審査請求】

未請求

(21)【出願番号】

特願平11-284629

(22)【出願日】

平成11年8月31日(1999. 8. 31)

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Abstract

(57)【要約】

[Form of Application]

document

[Number of Pages in Document]

4

[Theme Code (For Reference)]

3 K0343K092

[F Term (For Reference)]

3 K034 AA02 AA05 AA07 AA08 AA10 AA24 AA34 BB05
BB08 BB13 BB15 BB16 BC 02 BC 03 BC 09 BC 16 BC 17
BC 23 3K092 QA05 QB21 QB31 QB76 RF02 RF03 RF04
RF11 RF14 RF26 RF27 TT27 VV03 VV40

[Request for Examination]

Unrequested

(21) [Application Number]

Japan Patent Application Hei 11 - 284629

(22) [Application Date]

1999 August 31 days (1999.8. 31)

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(57) [Abstract]

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【課題】

種々の優れた特性を付与することが可能であつて、かつ最終製品への加工性および作業性が良好であり、長期使用安定性に優れた面状発熱体を提供すること。

【解決手段】

面状発熱機能を有する PTC 導電性基材と面状発熱機能を有しない基材とを合体せしめてなる面状発熱体。

Claims

【特許請求の範囲】

【請求項 1】

面状発熱機能を有する PTC 導電性基材と面状発熱機能を有しない基材とを合体せしめてなる面状発熱体。

【請求項 2】

面状発熱機能を有する PTC 導電性基材が繊維布帛に導電性塗料を含浸もしくは塗布したものであること特徴とする請求項 1 記載の面状発熱体。

【請求項 3】

面状発熱機能を有しない基材が樹脂、木材、セラミック、または金属から選ばれた素材からなることをする PTC 導電性基材が繊維布帛に導電性塗料を含浸もしくは塗布したものであること特徴とする請求項 1 または 2 に記載の面状発熱体。

【請求項 4】

合体の形態が面状発熱機能を有しない基材中への面状発熱機能を有する PTC 導電性基材の埋設であること特徴とする請求項 1-3 のいずれかに記載の面状発熱体。

【請求項 5】

面状発熱機能を有しない基材として複数の樹脂板を使用し、これらの間に面状発熱機能を有する PTC 導電性基材を挿入し、プレスして埋設を行ってなる請求項 4 記載の面状発熱体。

【請求項 6】

[Problems to be Solved by the Invention]

various characteristic which is superior is granted being possible, at same time fabricability and workability to final product being satisfactory, offer planar heater which is superior in long-term use stability.

[Means to Solve the Problems]

engaged body doing substrate which does not possess PTC electrically conductive substrate and the planar heat emission function which possess planar heat emission function, planar heater, which becomes

[Claim(s)]

[Claim 1]

engaged body doing substrate which does not possess PTC electrically conductive substrate and the planar heat emission function which possess planar heat emission function, planar heater, which becomes

[Claim 2]

PTC electrically conductive substrate which possesses planar heat emission function in cloth electrically conductive paint impregnation or coating fabric planar heater, which is stated in the Claim 1 which is made thing feature which is something which is done

[Claim 3]

PTC electrically conductive substrate which consists of material where substrate which does not possess planar heat emission function is chosen from resin, wood, ceramic, or metal and does in cloth electrically conductive paint impregnation or coating fabric the planar heater, which is stated in Claim 1 or 2 which is made thing feature which is something which is done

[Claim 4]

planar heater, which is stated in any of Claim 1-3 which is made the thing feature which is a embedding of PTC electrically conductive substrate which possesses planar heat emission function to in substrate where morphological form of engaged body does not have planar heat emission function

[Claim 5]

Using resin sheet of plural as substrate which does not possess planar heat emission function, inserting PTC electrically conductive substrate which possesses planar heat emission function at the set time, press doing and doing embedding planar heater, which it states in Claim 4 which becomes

[Claim 6]

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樹脂板が FRP 樹脂板であることを特徴とする請求項 5 記載の面状発熱体。

【請求項 7】

合体の形態が積層であることを特徴とする請求項 1-3 のいずれかに記載の面状発熱体。

【請求項 8】

積層が、面状発熱機能を有しない基材を形成する能力を有する液状またはペースト状の樹脂、ゴム、または塗料を面状発熱機能を有する PTC 導電性基材上に塗布または含浸してなることを特徴とする請求項 7 記載の面状発熱体。

【請求項 9】

積層が、面状発熱機能を有する PTC 導電性基材に面状発熱機能を有しない基材をラミネートしてなることを特徴とする請求項 7 記載の面状発熱体。

【請求項 10】

面状発熱機能を有しない基材が樹脂フィルムであることを特徴とする請求項 9 記載の面状発熱体。

Specification

【発明の詳細な説明】

【0001】

【発明の属する技術分野】

本発明は、種々の優れた特性を付与することが可能であって、かつ最終製品への加工性および作業性が良好であり、長期使用安定性に優れた面状発熱体に関する。

【0002】

【従来の技術】

従来、面状発熱体として、約 100 deg C 以下の低温領域において自己温度制御性(PTC 特性)を有しない抵抗発熱体、たとえばニクロム線を使用した発熱体は広く利用されている。

しかし、これらの宿命的欠陥は、温度が、実用上または安全上好ましくない程度に高い領域までに上昇する危険があり、複雑な過熱防止機構が必要であった。

また、PTC 特性を有する導電性樹脂をたとえば繊維布帛上に形成し、これを面状発熱体として

resin sheet is FRP resin sheet and planar heater, which is stated in Claim 5 which is made feature

【Claim 7】

morphological form of engaged body is laminate and planar heater, which is stated in any of Claim 1-3 which is made feature

【Claim 8】

laminate, coating fabric or impregnating resin, rubber, or paint of liquid state or paste which possesses capacity which forms substrate which does not possess planar heat emission function on PTC electrically conductive substrate which possesses planar heat emission function planar heater, which is stated in Claim 7 which becomes and makes feature

【Claim 9】

laminate, laminating substrate which does not possess planar heat emission function in PTC electrically conductive substrate which possesses planar heat emission function, planar heater, which is stated in Claim 7 which becomes and makes feature

【Claim 10】

substrate which it does not possess planar heat emission function is resin film and planar heater, which is stated in Claim 9 which is made feature

【Description of the Invention】

【0001】

【Technological Field of Invention】

this invention, various characteristic which is superior is granted being possible, at same time fabricability and workability to final product being satisfactory, regards planar heater which is superior in long-term use stability.

【0002】

【Prior Art】

Until recently, heater which uses resistance heater, for example nichrome wire which does not possess self temperature-regulating property (PTC characteristic) as planar heater, in low temperature domain below approximately 100 deg C is widely utilized.

But, as for these fatal defect, temperature, in regard to utility or was a hazard which with respect to safety in desirable extent rises to high domain, complex overheating prevention mechanism was necessary.

In addition, it forms electrically conductive resin which possesses PTC characteristic on the for example cloth, this

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使用することが行われている。

しかし、これらの宿命的欠陥は、安定性に欠けており、信頼されるものが無く、特に長期使用後の経時変化等を免れ得ないこと、加工性に乏しく、これらを組み込んだ最終製品の設計に大きな制約を課していることである。

[0003]

[発明が解決しようとする課題]

従って、本発明の目的は、種々の優れた特性を付与することが可能であって、かつ最終製品への加工性および作業性が良好であり、長期使用安定性に優れた面状発熱体を提供することにある。

[0004]

[課題を解決するための手段]

本発明者らが鋭意検討した結果、本発明の上記目的は下記の構成を有する本発明によって工業的に有利に達成された。

[0005]

(1)面状発熱機能を有する PTC 導電性基材と面状発熱機能を有しない基材とを合体せしめてなる面状発熱体。

[0006]

(2)面状発熱機能を有する PTC 導電性基材が繊維布帛に導電性塗料を含浸もしくは塗布したものであること特徴とする上記(1)記載の面状発熱体。

[0007]

(3)面状発熱機能を有しない基材が樹脂、木材、セラミック、または金属から選ばれた素材からなることをする PTC 導電性基材が繊維布帛に導電性塗料を含浸もしくは塗布したものであること特徴とする上記(1)または(2)に記載の面状発熱体。

[0008]

(4)合体の形態が面状発熱機能を有しない基材中への面状発熱機能を有する PTC 導電性基材の埋設であること特徴とする上記(1)~(3)のいずれかに記載の面状発熱体。

you use it is done as planar heater.

But, these fatal defect are insufficient in stability, any which the reliability are done are not, escape change over time etc after especially long-term use cannot, it is to assign constraint which is large to design of final product which is lacking in fabricability, installs these.

[0003]

[Problems to be Solved by the Invention]

Therefore, as for objective of this invention, various characteristic which is superior is granted being possible, at same time fabricability and workability to final product being satisfactory, it is to offer the planar heater which is superior in long-term use stability.

[0004]

[Means to Solve the Problems]

these inventors result of diligent investigation, as for above-mentioned objective of the this invention was achieved to industrially profitably with this invention which possesses below-mentioned constitution.

[0005]

engaged body doing substrate which does not possess PTC electrically conductive substrate and the planar heat emission function which possess [1] planar heat emission function, planar heater, which becomes

[0006]

PTC electrically conductive substrate which possesses [2] planar heat emission function in cloth electrically conductive paint impregnation or coating fabric planar heater. which is stated in the above-mentioned [1] which is made thing feature which is something which is done

[0007]

PTC electrically conductive substrate which consists of material where substrate which does not possess [3] planar heat emission function is chosen from resin, wood, ceramic, or metal and does in cloth electrically conductive paint impregnation or coating fabric planar heater. which is stated in above-mentioned [1] or [2] which is made thing feature which is something which is done

[0008]

Description above which is made thing feature which is a embedding of PTC electrically conductive substrate which possesses planar heat emission function to in substrate where morphological form of [4] engaged body does not have planar heat emission function [1] - planar heater. which is stated in any of [3]

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[0009]

[5]面状発熱機能を有しない基材として複数の樹脂板を使用し、これらの間に面状発熱機能を有する PTC 導電性基材を挿入し、プレスして埋設を行ってなる上記[4]記載の面状発熱体。

[0010]

[6]樹脂板が FRP 樹脂板であることを特徴とする上記[5]記載の面状発熱体。

[0011]

[7]合体の形態が積層であることを特徴とする上記[1]～[3]のいずれかに記載の面状発熱体。

[0012]

[8]積層が、面状発熱機能を有しない基材を形成する能力を有する液状またはペースト状の樹脂、ゴム、または塗料を面状発熱機能を有する PTC 導電性基材上に塗布または含浸してなることを特徴とする上記[7]記載の面状発熱体。

[0013]

[9]積層が、面状発熱機能を有する PTC 導電性基材に面状発熱機能を有しない基材をラミネートしてなることを特徴とする上記[7]記載の面状発熱体。

[0014]

[10]面状発熱機能を有しない基材が樹脂フィルムであることを特徴とする上記[9]記載の面状発熱体。

[0015]

本発明の最大の特徴は、面状発熱機能を有する PTC 導電性基材と面状発熱機能を有しない基材とを合体せしめて、従来の面状発熱体の欠点を解消し、種々の優れた品質を持ち、かつ、安定性および安全性に優れた面状発熱体を提供した点にある。

[0016]

[発明の実施の形態]

本発明において、面状発熱機能を有する PTC 導電性基材としては、特に制限されず、従来公知のいかなるものも使用可能であり、典型的に

[0009]

Using resin sheet of plural as substrate which does not possess [5] planar heat emission function, inserting PTC electrically conductive substrate which possesses planar heat emission function at these time, press doing and doing embedding planar heater. which it states in above-mentioned [4] which becomes

[0010]

[6] resin sheet is FRP resin sheet and planar heater. which is stated in the above-mentioned [5] which is made feature

[0011]

morphological form of [7] engaged body is laminate and description above which is made feature [1] - planar heater. which is stated in any of [3]

[0012]

[8] laminate, coating fabric or impregnating resin, rubber, or paint of liquid state or paste which possesses capacity which forms the substrate which does not possess planar heat emission function on PTC electrically conductive substrate which possesses planar heat emission function planar heater. which is stated in the above-mentioned [7] which becomes and makes feature

[0013]

[9] laminate, laminating substrate which does not possess planar heat emission function in PTC electrically conductive substrate which possesses planar heat emission function, planar heater. which is stated in above-mentioned [7] which becomes and makes feature

[0014]

substrate which it does not possess [10] planar heat emission function is resin film and planar heater. which is stated in above-mentioned [9] which is made feature

[0015]

There is a point which offered planar heater where maximum feature of the this invention engaged body doing substrate which does not possess PTC electrically conductive substrate and planar heat emission function which possess planar heat emission function, cancels deficiency of conventional planar heater, various with quality which is superior, at sometime, is superior in stability and safety.

[0016]

[Embodiment of the Invention]

Regarding to this invention, especially not to be restricted as PTC electrically conductive substrate which possesses planar heat emission function, every ones of prior public knowledge

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は導電性塗料を繊維布帛、たとえば不織布に含浸させ、乾燥、加熱工程を経て作製されたものが用いられる。

繊維布帛には、予め導線を内包するものを用いるのが好ましい。

加熱方法としては、たとえば、遠赤外線照射、マイクロウェーブ照射、誘電加熱等が利用出来るが、これらに限定されるものではなく、適切な温度管理が可能のものであればよく、また、導電性塗料の溶媒の発散速度に塗膜の表面と内部とで差ができない方法が好ましい。

[0017]

面状発熱機能を有する PTC 導電性基材として糸に導電性塗料を含浸させて得たものも使用可能である。

糸に導電性塗料を含浸させて PTC 導電性を付与せしめた糸を紡織することにより面布となし、これを用いるのである。

この場合、電極に用いる導線も任意の素材を選択することが出来、紡織の際任意の形状に挿入することができる。

また、面状発熱体の横糸の方向に電圧を加えると、縦糸には殆ど電圧が加わらず、発熱機能を発揮しない。

この場合、面布に導電性塗料を含浸させた糸を使用し、導電性塗料を含浸させていない糸との組合わせで紡織すれば、電圧が加わる方向の糸のみに、発熱機能を付与させることで、塗料の節約が可能となる。

この場合、導電性塗料を含浸させる糸に、たとえば、ナイロン等のような引張強度の高い繊維を撻り合わせたケーブルを使用することにより発熱体の強度を増強することが出来る。

[0018]

面状発熱機能を有しない基材の素材は、特に制限を受けず、たとえば樹脂、木材、セラミック、および金属等が挙げられるが、樹脂が特に好ましい。

[0019]

本発明の面状発熱体は、面状発熱機能を有する PTC 導電性基材と面状発熱機能を有しない基材とを合体せしめたものであるが、合体の態様としては、面状発熱機能を有する PTC 導電性

with the usable, in typical impregnating electrically conductive paint in cloth, for example non-woven fabrics, passing by drying and heating step it can use those which are produced.

It is desirable to use those which encapsulation do conductor, beforehand to cloth.

As heating method, it can utilize for example far infrared irradiation, microwave lighting and inductive heating etc, but if not to be something which is limited in these, it should have been something where appropriate temperature control is possible, in addition, the method which cannot achieve difference with surface and internal of coating in emission velocity of solvent of electrically conductive paint is undesirable.

[0017]

Impregnating electrically conductive paint in yarn as PTC electrically conductive substrate which possesses planar heat emission function, also those which it acquires are usable.

Impregnating electrically conductive paint in yarn, surface fabric it forms by the textile doing, yarn which grants PTC electrical conductivity uses this.

In this case, also conductor which is used for electrode selects the material of option to be possible, case of textile it can insert in shape of option.

In addition, when voltage is added to direction of weft of the planar heater, voltage does not join to warp almost, does not show heat emission function.

In this case, you use yarn which impregnates electrically conductive paint in the surface fabric and if textile you do with combination with the yarn which does not impregnate electrically conductive paint, by fact that heat emission function is granted to only yarn of direction where voltage joins, conservation of paint becomes possible.

In this case, to yarn which impregnates electrically conductive paint, reinforces the intensity of heater is possible by using cable which intertwines fiber where for example nylon or other tensile strength is high.

[0018]

material of substrate which it does not possess planar heat emission function not to receive especially restriction, for example resin, wood, ceramic, and metal etc can list, but resin especially is desirable.

[0019]

As for planar heater of this invention, you can list embedding, to substrate which does not possess planar heat emission function of PTC electrically conductive substrate which possesses planar heat emission function PTC

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基材の面状発熱機能を有しない基材への埋設、および両者の積層が挙げられる。

【0020】

埋設の典型的な方法は、面状発熱機能を有しない樹脂板の間に面状発熱機能を有する PTC 導電性基材を挿入し、加熱・プレスする方法である。

この際、樹脂板として FRP 樹脂板を使用することが、得られる面状発熱体の強度及び安定性の向上の為に、好ましい。

たとえば、FRP プレート間に面状発熱機能を有する PTC 導電性基材を挿入し、プレス加工により、PTC 導電性基材を内包する FRP 成形品を製作する場合、面布の目開きを調整することで、FRP の浸透を容易にし、剥離の防止効果が高くなる。

【0021】

面状発熱機能を有する PTC 導電性基材と面状発熱機能を有しない基材との積層体を得る典型的な方法は、ラミネート法である。

また、塗布法及び含浸法も採用し得る。

これは、面状発熱機能を有しない基材を形成する能力を有する液状またはペースト状の樹脂、ゴム、または塗料を面状発熱機能を有する PTC 導電性基材上に塗布または含浸する方法である。

【0022】

以上のように、面状発熱機能を有しない基材の面状発熱機能を有する PTC 導電性基材への埋設または積層により数々の優れた性質を有する面状発熱体を提供することが出来る。

面状発熱機能を有しない基材の素材として典型例である樹脂を使用したケースで説明すると、樹脂の種類を適宜選択することにより、耐水性、防火性、耐火性、耐熱性、絶縁性、及び電気抵抗の安定性等の特性を面状発熱体に付与することができ、また、面状発熱体の形態安定性、強度、及び作業性等を向上せしめることができる。

electrically conductive substrate and planar heat emission function which possess planar heat emission function it is something which substrate which does not possess the engaged body is done but, as embodiment of engaged body, and laminate of the both.

【0020】

As for typical method of embedding, PTC electrically conductive substrate which possesses planar heat emission function between resin sheet which it does not possess planar heat emission function is inserted, it is a method which heating press is done.

In this case, FRP resin sheet is used as resin sheet intensity of planar heater which, is acquired and for improving stability, is desirable.

PTC electrically conductive substrate which possesses planar heat emission function between for example FRP plate is inserted, when FRP molded article which PTC electrically conductive substrate encapsulation is done is produced with press forming, by fact that mesh opening of surface fabric is adjusted, permeation of FRP is made easy, preventing effect of exfoliation becomes high.

【0021】

typical method which obtains laminate of PTC electrically conductive substrate which possesses planar heat emission function and substrate which does not possess planar heat emission function is the lamination method.

In addition, it can adopt also painting method and impregnation method.

This resin, rubber, or paint of liquid state or paste which possesses capacity which forms substrate which does not possess planar heat emission function coating fabric or is method which is impregnated on PTC electrically conductive substrate which possesses planar heat emission function.

【0022】

Like above, many planar heater which possesses property which is superior is offered is possible with embedding or laminate to PTC electrically conductive substrate which possesses planar heat emission function of substrate which does not possess planar heat emission function.

When you explain with case which uses resin which is a typical example as material of substrate which does not possess planar heat emission function, the stability or other characteristic of water resistance, flame resistance, fire resistance, heat resistance, insulating property, and electrical resistance is granted to planar heater by selecting kind of resin appropriately, to be possible, in addition, morphological form stability, intensity, and workability etc of planar heater improve is possible.

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[0023]

本発明において、かかる樹脂として、特に制限を受けないが、埋設用には FRP 樹脂が好ましく、ラミネート用としてはポリエステル、ポリアミド、ポリエチレン、ポリプロピレン、及びポリスチレン等が好ましく、また、塗布・含浸用としてはウレタン系熱可塑性樹脂及びアクリロニトリル/ブタジエン樹脂等が好ましい。

[0024]

[実施例]

以下、実施例により本発明を更に具体的に説明するが、本発明はこれに限定されるものではない。

[0025]

[実施例 1]

グラファイト(日本グラファイト社製:SP-20)3.5kg、アセチレンブラック(電気化学社製:デンカブラック)1.5kg、をエチレン/プロピレン/ステレンコポリマー(シェル社製:Kraton G1701)5kg、ポリスチレン 1kg、パラフィン 4kg、及び MEK/キシレン=20/80 の混合溶媒 15kg よりなる溶液に添加し、均一なペーストとした後、これを 1.5 倍量のキシレンで希釈し発熱材を含むコーティング液を調整した。

[0026]

一方、約 5mm の間隔で巻繞したポリエステル/綿混紡糸(20/2 メートル番手)の中に良導電性線条物として 275dtex/f のポリエステルフィラメント糸の表面に幅約 0.3mm の銅箔を巻いたカバーリング糸 5 本を引き揃えて約 10cm 間隔で配置し、綿糸にポリエステル/綿混紡糸(20/2 メートル番手)を用いて約 5mm 間隔で打ち込んで幅約 3m の目の粗い織物を形成し、得られた織物を上記コーティング液に浸漬して、軽くロールで絞った後、加熱乾燥した。

かくして、目開き約 3mm の面状発熱機能を有する PTC 導電性基材を得た。

[0027]

この PTC 導電性基材を 10mm の厚みのガラス繊維を含む不飽和ポリエステル樹脂からなるガラス繊維強化樹脂板 2 枚の間に挿入し、150

of planar heater improve is possible.

[0023]

Regarding to this invention, it does not receive especially restriction as this resin. FRP resin is desirable in one for embedding, polyester, polyamide, polyethylene, polypropylene, and polystyrene etc are desirable as one for laminating, in addition, urethane thermoplastic resin and acrylonitrile/syndiotactic 1,2-polybutadiene etc are desirable as one for coating fabric * impregnation.

[0024]

[Working Example(s)]

this invention furthermore is explained concretely below, with Working Example, but this invention is not something which is limited in this.

[0025]

[Working Example 1]

graphite (Japan graphite supplied:SP-20) 3.5 kg, acetylene black (Denki Kagaku Kogyo Kabushiki Kaisha (DB 69-056-8985) make:Denka Black) 1.5 kg, ethylene/propylene/styrene copolymer (Shell make:Kraton G1701) were added to 5 kg, polystyrene 1 kg, paraffin 4 kg, and solution which consists of mixed solvent 15 kg of MEK/xylene=20/80, after making uniform paste, this 1.5-fold amount was diluted with xylene and coating liquid which includes heat emission material was adjusted.

[0026]

On one hand, with spacing of approximately 5 mm making good electrical conductivity wire ones in polyester/cotton blended yarn (20/2 meter count) which diameter adjustment is done it pulls the covering yarn 5 which winds copper foil of width approximately 0.3 mm in surface of polyester filament yarn of 275 dtex/f and arranges and arranges with approximately 10 cm spacing, it rams down to filling yarn with approximately 5 mm spacing making use of polyester/cotton blended yarn (20/2 meter count) and forms coarse grain woven article of width approximately 3 m, Soaking woven article which it acquires in above-mentioned coating liquid, after squeezing lightly with roll, thermal drying it did.

This way, PTC electrically conductive substrate which possesses planar heat emission function of mesh opening approximately 3 mm was acquired.

[0027]

It inserted this PTC electrically conductive substrate between glass fiber-reinforced resin sheet 2 which consists of unsaturated polyester resin which includes glass fiber of

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deg C の温度でプレスした。

かくして PTC 導電性基材が FRP 樹脂中に埋設された本発明にかかる面状発熱体を取得した。

この面状発熱体は上記 PTC 導電性基材と電気抵抗値がほとんど変わらず、また形態安定性、耐水性、耐火性および絶縁性が極めて良好であった。

[0028]

[実施例 2]

実施例 1 で得られた面状発熱機能を有する PTC 基材をアクリロニトリル/ブタジエン樹脂ラテックス中に浸漬し、ローラーニップにより絞り、次いで 90 deg C で乾燥した。

アクリロニトリル/ブタジエン樹脂の付着量は固形分で面状発熱機能を有する PTC 基材に対して 12 重量%であった。

かくして本発明にかかる面状発熱体を取得した。

この面状発熱体は上記 PTC 導電性基材と電気抵抗値がほとんど変わらず、また柔軟性、耐水性、耐火性、形態安定性および絶縁性が極めて良好であった。

特に柔軟性と形態安定性を兼備しているので、使用時の作業性が優れていた。

[0029]

[発明の効果]

本発明によれば、耐水性、防火性、耐火性、耐熱性、絶縁性、及び電気抵抗の安定性等の特性を面状発熱体に付与することができ、また、面状発熱体の形態安定性、強度、及び作業性等を向上せしめることが可能である。

従って、面状発熱体を種々の用途に極めて有利に使用することができる。

thickness of 10 mm press did with temperature of 150 deg C.

PTC electrically conductive substrate acquired planar heater which depends on this invention which the embedding is done in FRP resin in this way.

As for this planar heater above-mentioned PTC electrically conductive substrate and electrical resistance did not change for most part, in addition morphological form stability, water resistance, fire resistance and insulating property quite were satisfactory.

[0028]

{Working Example 2 }

It soaked PTC substrate which possesses planar heat emission function which is acquired with Working Example 1 in acrylonitrile/syndiotactic 1,2-polybutadiene latex, drawing, it dried next with 90 deg C with roller nip.

amount of deposition of acrylonitrile/syndiotactic 1,2-polybutadiene was 12 wt% vis-a-vis PTC substrate which possesses planar heat emission function with solid component.

planar heater which depends on this invention this way was acquired.

As for this planar heater above-mentioned PTC electrically conductive substrate and electrical resistance did not change for most part, in addition softening, water resistance, fire resistance, morphological form stability and insulating property quite were satisfactory.

Especially because softening and morphological form stability are combined, workability when using was superior.

[0029]

[Effects of the Invention]

According to this invention, stability or other characteristic of water resistance, flame resistance, fire resistance, heat resistance, insulating property, and electrical resistance is granted to planar heater to be possible, in addition, morphological form stability, intensity, and workability etc of planar heater it improves it is possible.

Therefore, planar heater quite can be used for various application profitably.